

## Conference Reports: Ecobalance IV

### Ecobalance IV \*

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This fourth conference, in a biannual series, united 428 practitioners of Life Cycle Assessment to discuss practical aspects related to the application of the methodology. This represents a twenty percent increase in participation over the last meeting, also held in Tsukuba, Japan. Representatives at the October 31 to November 2nd meeting came from twenty other countries including Australia, China, Indonesia, Thailand and Europe (Germany, France, Italy, The Netherlands, Sweden, Norway, Portugal and Switzerland). Presentations from the Middle East, the United States and Canada also complimented the program. The last two days of the conference coincided with a regional meeting on LCA for APEC Member Economies. Extended, four-page, abstracts were provided in the conference proceedings for each of the over 200 papers. Japanese and English versions of each paper in the plenary and four parallel sessions as well as for the fifteen posters and thirteen softwares demonstrated was provided. All sessions included simultaneous Japanese-English translations.

The Ecobalance series unites selected European and American academics, with a predominantly Asian set of industrialists to discuss advances in LCA practice as well as metrics. Ecobalance IV focussed on five 'special' areas, Eco-Indicators and Eco-Metrics, EcoDesign, EcoMaterials, Eco-Rating and Eco-Damage Function. One Opening and two Plenary lectures began the meeting. Six Invited lectures, complimented with panel discussions, concluded the first morning and last afternoon of the conference. Ecobalance IV was characterized, in addition to the traditional debate on impact assessment methodologies which highlight Life Cycle Assessment meetings, with a large number of screened case studies. The following sections highlight the plenary and invited lectures, panel discussions and deliberations of the special sessions.

#### 1 Opening Lecture

(R. Yamamoto, University of Tokyo)

From Professor Yamamoto's extensive, and well presented comments it is unclear if there has been significant international political progress over the past two years in areas where LCA would have played a critical policy role. While the 1996-1998 period saw orientation toward recycling as well as legislation in this regard, recent emphases have reverted to the scientific domain, with some compliment in 'green' investment funds and credit. Professor Yamamoto also mentioned the special issue of the International Journal of LCA related to Japan, edited by M. Finkbeiner (DaimlerChrysler, D) and Y. Matsuno (National Institute for Resources and Environment, Japan).

#### 2 Plenary Lecture: Environmental Management in the 21st Century

(N. Ohga, CEO Sony Corporation)

Currently, each of Sony's 190,000 employees are involved in at least one environmental activity. New employees also receive

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specific environmental training. Ohga's vision for Sony is that the life cycle energy and material needs of Sony's products 'steadily decrease'. Their priorities are global warming and waste related issues. An example of the latter is Sony's reuse of foamed polystyrene via dissolution, on site of purchase, using an orange peel extract with similar solubility parameters to styrene. Furthermore, video cameras have eliminated 65% of their weight and energy use over the past fifteen years. Sony is now working on the recycling of glass and, more significantly, a new business model wherein music is provided as a service, over the web, rather than a product.

In one century, Japan's energy use has increased 50,000 fold. Ohga believes this is due to a customization with a high standard of living in selected global regions, in particular, a heightened reliance on electricity as well as family related goods including television and air conditioning.

#### From Energy Analysis to LCA

(Y. Kaya, Research Institute of Innovative Technology for the Earth)  
The energy analyses of the 1970s have been replaced by Life Cycle Assessments in the 1990s. Indicators have shifted from energy efficiency and payback, based on input/output analyses, to impact related parameters such as GWP. By expanding scope, however, LCA introduces subjectivity, at least in regards to weighting.

#### 3 Opening Panel Session: Present State and Problems on the use of Ecobalance Tools

##### Standardization in European LCA

(G. Huppkes, Leiden University, NL)

Predicting the consequences of environmental effects such as the increase in sea levels, requires assumptions, or values, to be introduced into the modeling. These include items such as the speed of response to floods in the Netherlands and Bangladesh, as well as macroeconomic market reaction to crises. Huppkes believes that efforts are required in standardization of LCA, as well as objectivity related to LCA's conclusions. Mary Ann Curran (US EPA) voiced similar opinions in relations to LCAs conclusions).

##### Overview of Various Users and Uses of Ecobalances in the USA (M.A. Curran, US-EPA)

Ms. Curran believes that the larger US firms are waiting for ISO 14000 to lead LCA to a single tool. The US Government's Department of Defense and Department of Energy are involved in life cycle costing, as an extension of pollution prevention activities. Their focus is predominantly in relation to procurement. Many of these programs date to 1995 and one has to question if LCA has not lost its constituency and momentum. Curran noted that the EPA is constructing a web page (LCAccess) which summarizes the data bases available, both on and off-line. Projects are also related to decision making (FRED), where LCA can be used as a justification for federal purchases.

**LCA Practices for Typical Materials: The Chinese Example**

(Z.H. Jin, Xian Jiaotong University, China; represented by R. Yamamoto)

China's desertification occurs at a rate of 78 square meters per second! Environmental issues include water quality and air pollution, with the latter a growing concern due to highway construction and energy use. Interestingly, China now leads the globe in air conditioner purchases. Their LCAs have focused on raw material related industries including steel, plastics, glass and cement (LCI). Plastics waste is, for example, deteriorating agricultural land.

**Gap between LCA Experts and Industry Users**

(Z. Murata, Japan Environmental Management Association for Industry, formerly of Konica Corporation)

Japan reports a higher number of streamline LCAs relative to Europe, though they conduct less life cycle inventories and focus their impact assessment solely on carbon dioxide equivalents. Overall, Murata presented a very skeptical view of the practicality of LCA, stating that it is loosing its momentum in industry. Murata noted that LCA experts abroad expressed a frustration at not being able to access Japan's input/output databases of over 400 industrial sectors.

**4 Summary of Special Sessions****Eco-Efficiency and Eco-Metrics**

Schmidt-Bleek (Factor 10 Institute, F) began the session by noting that Factor 4 to 10 improvements in resource productivity will be required to move to a sustainable society. He also reintroduced the Material Intensity Per Unit Service (MIPS) concept. Schmidt-Bleek believes that the economy must be changed in ways acceptable to GATT, the WTO, the OECD and the World Bank. Hunkeler (Swiss Federal Institute of Technology) noted that we should focus on LCA's conclusions and, thereby, validate product, service and industry-specific metrics.

A case study on PVC from Professor Yasui's group at the University of Tokyo noted that material sales will be very sensitive to how the upstream supply chain (e.g. chlorine) is regulated. Mr. Kaneko (Ebara Corporation) noted that EcoDesign requires an increase in MIPS concomitant with a reduction in life cycle costs. Similarly, Mr. Masuda (Fuji Xerox) stated that Factor-X reductions require innovation instead of just improvement. A specific case on Ultra-High Rise Structures (1000m, 100 thousand people with a durability of 1000 years) was studied by the Kajima Corporation. Mr. Kitama defined, in this regard, Eco-efficiency as a ratio of life cycle utility to either life cycle impact or cost.

Mr. Partidario (INETI, Portugal in collaboration with TU Delft, NL) examined the painting supply chain. Changes in water and energy utilization were not found to yield Factor-X improvements. Furthermore, the supply chain can hinder the acceptance (public and political) of new technologies. Mark Goedkoop (Pre, NL) concluded the session by presenting the results of a dematerialization study for the Dutch government. Many service sectors have higher environmental loads than for production, implying a limitation to Factor-X approaches. Goedkoop used his 'E2' approach where environmental load is plotted as a function of value creation. Agriculture, electricity, transport, oil and gas had the largest loads.

In the panel discussion, Schmidt-Bleek noted that if leasing functionality replaces sales then industry will become the predominant owner of goods. Furthermore, Factor-2 improvements are often the limit of profitability, implying that a new tax structure could be considered. The Japanese noted that a new concept in durable goods sales is continuous customization. Overall, the session chair drew three conclusions:

- Eco-Indicators and Eco-Metrics must be life cycle validated
- EcoDesign's objectives should be life cycle validated
- Sustainability requires innovation.

**EcoDesign**

EcoDesign is one of the bridges between LCA and sustainability. It is also an applied LCA which is 'outcome focused'. The advantages of LCA in design processes was presented by T. Grant (RMIT, Australia). Hunkeler presented a design survey noting that design times are short and this requires digestible environmental information. Baitz (University of Stuttgart, D) examined sector specific EcoDesign tools with relative information and indicators. Rombouts (Technical University of Delft, NL) presented a case study on previous LCA studies to make predictions in regards to product development. Dr. Umeda (Tokyo Metropolitan University, Japan) discussed the application of LCA in closed economy recycling and the need to link environmental and management issues. A series of case studies on EcoDesign were then presented including those for a washing machine, air conditioners and the automated disassembly. In summary, LCA tools are needed to meet the needs of designers with specific tools required in each sector.

**EcoMaterials**

S. Chubbs (Virterra, Vancouver, Canada) began the session discussing temporal aspects. Biodegradable materials for electronic applications as well as the material selection in construction were discussed. The latter pointed out the need to establish return channels. Eco-Friendly wires and an LCI of beverage packaging were subsequently presented. Robert (The Natural Step Foundation, Sweden) discussed the need to move from marginal improvements to strategic planning. The final paper discussed requirements of a recycling plant to material manufacturers. Chubbs believes that sustainable products, industry and society are linked. There is a need to adapt ecomaterials which lower the environmental burden. Methodologies need to include temporal aspects as well as total cost.

**Eco-Rating**

This session replaced a session in previous meetings on eco-labeling to reflect the need to incorporate social issues. Issues presented included an environmental calendar, which is a simplified approach for SMEs. Several firms presented papers their labeling efforts. The interactive society in a product based society was discussed. IPP and EPDs were discussed in reference to specific programs in Europe and Japan. Corporate environmental evaluation in eco-funds were also discussed, as was sustainable housing. A rational decision making system should be promoted, which will require reliable information (standardized format and review). The session concluded with five major points:

- Information disclosure requires stakeholder involvement
- Reliable information is required
- A product data base should be developed and standardized

- Third party reviews are needed
- New case studies are needed.

#### Eco-Damage Function

Eleven papers were presented. Dr. A. Inaba (National Institute for Resource and Environment, Japan) defined the concept with N. Itsubo (NIRE, Japan) discussing safeguard subjects and the concept of damage function. Eight specialized papers followed related to greenhouse gases (3), ozone depletion (2) and other specific impacts. A Japanese project aimed at categorizing the end-points, by the end of 2000. A comparison of the mid-point and end-point approaches is also in progress. The Future should include uncertainty analysis, a comparison of methodologies (e.g. EcoIndicator, EPS) and the increase in global discussion forums.

### 5 Closing Panel Discussion

#### Methodological Progress to Meet Users' Needs

(B.P. Weidema, LCA Consultants, DK)

Uncertainties in LCA include the identification of the processes to be included in the product system, technological mismatches between desired and available data and the uncertainty in the data as such. The minimum uncertainty an LCA can have is in forecasting of environmental and market/process data. Undefined geographical or temporal positioning of processes (e.g. due to free choice of suppliers) and unknown/uncontrollable causes of variation at a site specific level are also non-deterministic. Therefore, given these large market uncertainties, data does not have to be collected beyond these uncertainty.

#### Key Issues in LCA Methodology to Meet the Needs of the Manufacturing Industries

(M. Finkbeiner, DaimlerChrysler, D)

Finkbeiner suggests to separate the methodological development from the applications of LCA. The former needs good, and improving, science while the latter demands good, and improved, products or services. Finkbeiner uses the nomenclature 'New Screening LCA' which involves the optimization, or improvement, of a full LCA, which must be performed first. The effort reduction is in the subsequent applications. As an example, Daimler required two years for the first LCA of an automobile body, which was reduced to 50 days and eventually 1 day for subsequent analyses which he believes are of higher quality. Finkbeiner noted that the level of complexity required for decision making may be less than that which defines the optimal accuracy.

In regards to ISO 14000 standards, internal reporting can use single indicators, for example, whereas the standard is much more specific for external reporting. Finkbeiner believes that the ISO regulations for external reporting are not, generally, followed in case studies.

Finkbeiner sees LCA as having two principal applications in industry, as a tool for DfE as well as to assist environmental management in firms. He believes that LCA will not survive as a stand-alone tool. In the long term, LCA must be used to improve products, rather the present focus on marketing, communication and Type-III ecolabeling, which bring only short term benefits to the firm, and society.

#### Application of Economic Methods to Ecobalances

(T. Washida, Kobe University, Japan)

Professor Washida believes that the objective is to develop an integrated index for life cycle impact category data, depending on individual preferences (i.e. aggregating impact categories). He has carried out a survey of consumers of four products (televisions, PCs, automobiles and homes). A brochure complimented the survey with three impacts examined including life cycle carbon dioxide emissions, life cycle sulfur dioxide emissions and the recycling rate, all related to national environmental priorities. Consumers were asked to note their preference to scenarios via pairwise rating (27 questions). At the end, customers were asked if they would buy a product with a given set of characteristics. They determined customer willingness-to-pay for certain environmental attributes. For example, consumers are willing to pay two million Yen more for a house which reduced carbon dioxide emissions by one ton. Consumers are also willing to pay 80 thousand Yen more for a computer which reduces carbon dioxide by 10 kilograms. These represent green premiums on the order of 10%. Washida believes that such data can be incorporated into environmental accounting methods.

### 6 Concluding Question and Answer Panel Session

One panelist noted that only a limited number of Japan's many LCIs have been disclosed, predominantly due to their confidential data. In response to a question from the panel chair Itaru Yasui (University of Tokyo, Japan) in regards for a timeframe for implementation of LCA on a wide scale, panelists varied in their prediction from the mid term (15 years) to century-long perspectives. Hunkeler noted that in Switzerland life cycle thinking is already used, in a widespread way, to access credit. Finkbeiner added that if the government can develop environmentally correct taxes then there is no need for LCA.

The panel discussed the final target of ecobalances. Curran noted that we need intensified workshops, such as those which were held in the early 1990s and defined the field. Hunkeler added that, in agreement with the comments of Professor Yamamoto and Dr. Finkbeiner, Japan has a large number of very impressive case studies. These should be consolidated into validated indicators for specific products, services and industrial sectors. He recommended the nomination of a national commission to establish such an LCA toolbox. The panel concluded by recommending, though not unanimously, *a suite of LCA tools*. Weidma stated that LCA is a mature management tool used in daily decision making. Hunkeler countered by noting that aspects related to the decommissioning of major energy installations, including oil refineries, had not yet been sufficiently addressed and would be needed for LCA. Itaru Yasui commented that in Japan, sustainability has a predominantly environmental aspect, in difference to the economic and social connotations which are commonly associated with it in a US-EC context).

### 7 Closing Remarks

Professor Yasui concluded the conference by recommending that ecobalance be extended to tools other than LCA. He also feels a harmonization in methodologies would be beneficial and additional industry-university collaboration useful. Focused satellite conferences may be possible for Ecobalance V in November 2002.